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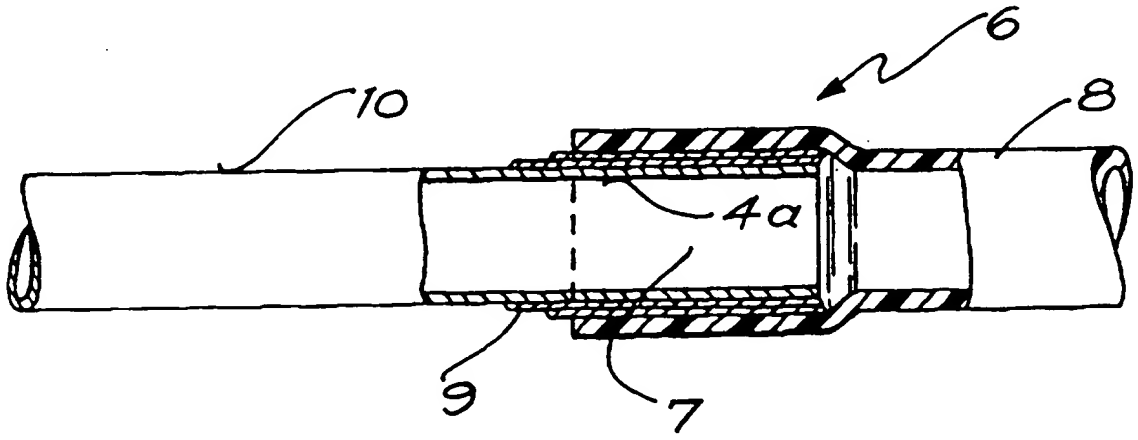

(57) Abstract

A pipe coupling (6) formed by engagement between a metal pipe or pipe fitting (7) and a plastics pipe end (8) wherein the plastics pipe end (8) is overmoulded over the metal pipe (7) or pipe fitting; characterised in that prior to formation of the coupling by overmoulding the metal pipe or pipe fitting is hot dipped in a bed of fluidised material.

As coupling technology developed, it was found that if a fitting which was leak proof could be effected without the use of a compression arrangement the joint would be less susceptible to the effects of plastic creep.

Another of the known coupling arrangements is disclosed in Australian patent 629307 by the same applicant. The coupling arrangement disclosed in that patent constitutes the mating of a metal fitting with one or more elongate plastic pipes or tubes wherein the inner or outer surface of the metal fitting is coated with a plastics material following which the end of a plastic tube or pipe is located either inside or about the outside of the metal tube. An adhesive is provided between adjacent surfaces of the plastic tube and the lining or coating, so that the plastic tube adheres to the metallic fitting.

According to the prior art methodology a coupling arrangement can be formed between a plastic and metal pipe whereby the metallic pipe end is primed prior to hot dipping. Following the hot dipping process a glue is applied to the outer or inner surface of the pipe depending upon whether the plastic pipe is to mate over the outside diameter or inside the inside diameter of the pipe. Once the glue is applied, the plastic is force fitted over the metallic end to thereby effect a sealable connection.

According to another known coupling method a plastic pipe is joined to a metal pipe fitting involving the following steps. The metallic pipe end is primed followed by overmoulding wherein the metallic pipe end is placed inside an injection mould in order to complete the connection. One difficulty which has been experienced with the latter coupling arrangement is that it is prone to leakage and can fail when the joint is under torsion. There are also difficulties in fusion stress and in bonding where differences in temperature are encountered in the same period due to different expansion between metal and plastic. Other difficulties arise in achieving consistency of moulding over the primer due to impurities or scratches not easily detected during the moulding operation. Another known coupling involves the joining of a coupling member welded to a metal pipe, which member undergoes overmoulding with a plastics material following insertion of the pipe in an injection mould. The problem with this arrangement is that an extra

fitting namely the coupling member is required to effect the join involving extra labour and material costs.

The present invention seeks to ameliorate the aforesaid prior art disadvantages by providing an alternative method of coupling between a plastic pipe or fitting and a metal pipe end or fitting to eliminate leakage in the fitting. According to the apparatus aspect of the invention there is provided a pipe coupling arrangement produced by application of the methodology of the invention.

In the broadest form of the method aspect, the present invention comprises; a method for effecting a coupling between a plastic pipe end or fitting and a metallic pipe or pipe fitting comprising the steps of:

a) applying an organic or inorganic primer to the metallic pipe or pipe fitting,

b) applying heat to the metallic pipe or fitting;

c) hot dipping the metallic pipe or pipe fitting;

d) introducing the hot dipped metallic pipe end or fitting into an injection moulding apparatus; then,

e) overmoulding the metallic pipe or pipe fitting with a plastics material to effect said coupling.

Preferably the primer is an epoxy based material. According to the preferred embodiment the primer is applied essentially to stop corrosion and performs an indirect role in adhesion in that it causes the coupling to resist corrosion thereby indirectly preserving the adhesion between the plastics material and the metallic material. The hot dipping process enhances the bonding between the metal and plastic resulting in enhanced adhesion and a homogenous coupling. Preferably, the metallic pipe or pipe fitting is hot dipped in a fluidised material which is the same as the material used for the overmoulding. In the preferred embodiment, the metallic pipe is thin walled.

According to one form of the apparatus aspect, the present invention comprises; a coupling arrangement between a metal pipe or pipe fitting and a plastics pipe end wherein the plastics pipe end is overmoulded over the metal pipe or pipe fitting

characterised in that prior to formation of the coupling by overmoulding the metal pipe or pipe fitting is hot dipped in a bed of fluidised material.

In another form of the apparatus aspect, the present invention comprises;

a coupling between a metal pipe or pipe fitting and a plastic pipe wherein the plastic pipe is overmoulded over the inner or outer surface of the end of the pipe or pipe fitting wherein the end of the metal pipe or pipe fitting is hot dipped prior to overmoulding.

In another form the present invention comprises:

a pipe coupling formed by engagement between a plastic pipe and a metal pipe or pipe fitting, wherein at least one of either the inner or outer surfaces of the region at or near the end of the metal pipe or pipe fitting is primed with an epoxy based primer before heating and hot dipping said region, and wherein said plastic pipe is formed from an injection mould whereby the plastic pipe is over moulded over the metal pipe or pipe fitting after hot dipping to effect said coupling.

According to the preferred embodiment, the pipe over which the plastic is over moulded is copper. The plastics material which is over moulded over the copper may include plastics such as thermoplastics such as polyamides (nylon), polyethylene or polypropylene. The plastics material is applied over the primer which is located between the plastics material and the metallic outer or inner surface of the pipe to be connected. Preferably, the hot dipping is into a fluidised bed of plastics material which is the same material as that used in the overmoulding.

The present invention will now be described in more detail with reference to the method and apparatus aspects according to preferred but non limiting embodiments and with reference to the accompanying illustrations wherein:

Figure 1: shows a known coupling arrangement according to the prior art and;

Figure 2: shows a coupling arrangement produced in accordance with the methodology of a preferred embodiment of the invention.

Referring to figure 1 there is shown an example of a known coupling 1. This coupling comprises a copper pipe end 2 which is mated with pipe end 3 formed from a plastics material. The coupling is effected by priming the outer surface 4 of the pipe end 2 with a primer 5. A glue is used to fuse the plastic pipe end to the metallic end thereby effecting a bond. Unfortunately this type of joint is prone to leakage particularly if a torsional load is placed about either the pipe end 2 or the plastic pipe end 3.

As a variation of the above described coupling arrangement, an alternative coupling may be formed by priming metal pipe end 2 then rather than mechanically urging pipe end 3 over the outer surface 4 of the pipe end 2 the plastic pipe end 3 is over moulded by inserting pipe end 2 into an injection mould. Unfortunately this arrangement is also prone to leaking, particularly if torsional loads are applied to the connection.

Referring now to figure 2 there is shown a cross sectional view of a pipe coupling arrangement according to a preferred embodiment of the apparatus aspect of the invention and produced in accordance with the method aspect.

Thus, figure 2 shows an enlargement of a pipe coupling arrangement 6 comprising a metallic pipe end 7 and a plastics pipe end 8. Ends 7 and 8 are mated according to the following regime.

Pipe end 7 which preferably comprises copper is primed with a priming layer 9 which guards the outer surface 10 of pipe end 7 against corrosion when the joint is constructed. The primer is preferably epoxy based or an organic or inorganic primer. The primer does not necessarily enhance the adhesion between the plastic pipe end 8 and metallic pipe end 7 but rather provides an environment whereby corrosion is resisted which indirectly ensures proper sealing engagement between the plastic pipe and the metallic pipe end.

If an inorganic primer is used the temperature of the pipe to be coated can be increased avoiding burning of the primer prior to hot dipping coating. Furthermore, use of an inorganic primer will not result in adverse effects on the pipe contents.

Following the priming step, pipe end 7 is hot dipped in a plastic material, following which plastic pipe end 8 is introduced over pipe end 7 by overmoulding. The hot dipping takes place in an ambient temperature fluidised bed. The item to be coated is heated to the proper temperature (150°c - 350°c) and then dipped into the fluidised bed containing plastic powder. The fluidised bed contains the same plastics material used for overmoulding the metallic pipe or pipe fitting. For instance, if the overmoulding is effected with nylon the metallic pipe or pipe fitting is hot dipped in nylon. The overmoulding takes place by use of an injection moulding apparatuses wherein pipe end 7, is following the steps of priming and hot dipping, urged into the injection moulding apparatus causing plastic overmoulding over pipe end 7. It will be appreciated that similar steps can be formed which can result in the plastic pipe end engaging the inner surface 4a of pipe end 7.

Previous attempts have been made to effect proper sealing engagement between an overmoulded plastic pipe end and a metallic fitting however, these have proven to be subject to leakage. One such method which was introduced in order to strengthen a plastic to metal coupling was the introduction of a coupling element between the pipe end and the over moulded plastic. The disadvantage of this method was that there was greatly increased costs in producing the joint due to the additional component part which required welding to the pipe end. This part had annular ribs which prevented axial relative movement between the pipe ends but added to the material costs.

The present invention eliminates the use of the connecting part having the annular ribs and although the embodiment shown in figure 2 does not have this component part it still, by virtue of the methodology of the present invention has the capability to resist withdrawal and/or leakage induced by torsional stress which may be induced in the coupling. In particular, the hot dipping step enhances the sealing engagement between the metal and plastic.

Furthermore, the present invention eliminates the additional step according to the prior art methodology of welding the connecting element (having the annular ribs) to the pipe end. As a result of the methodology of the present invention, a pipe coupling is

efficiently produced which results in reduced cost, reduced materials and labour and speed of construction.

The invention is particularly suitable for small bore piping (20 - 25mm) and larger piper with greater wall thickness.

It will be recognised by persons skilled in the art that numerous variations and modifications can be made to the invention as broadly described herein without departing from the overall spirit and scope of the invention.

THE CLAIMS:

1. A pipe coupling formed by engagement between a metal pipe or pipe fitting and a plastics pipe end wherein the plastics pipe end is overmoulded over the metal pipe or pipe fitting;
characterised in that prior to formation of the coupling by overmoulding the metal pipe or pipe fitting is hot dipped in a bed of fluidised material.

2. A pipe coupling formed by engagement between a plastic pipe and a metal pipe or pipe fitting, wherein at least one of either the inner or outer surfaces of the region at or near the end of the metal pipe or pipe fitting is primed with an epoxy based primer before heating and hot dipping said region, and wherein said plastic pipe is formed from an injection mould whereby the plastic pipe is over moulded over the metal pipe or pipe fitting after hot dipping to effect said coupling.

3. A pipe coupling according to claims 1 or 2 wherein the pipe or pipe fitting is hot dipped in a fluidised bed of plastic powder.

4. A pipe coupling according to claim 3 wherein the metal pipe or pipe fitting is hot dipped in the same plastics material used to effect said overmoulding.

5. A pipe coupling according to claim 4 wherein the metallic pipe end is of thin cross section.

6. A pipe coupling according to claim 5 wherein the pipe ends are, when coupled, concentric such that an air and/or water tight seal is effected.

7. A pipe coupling according to claim 6 wherein the epoxy based primer performs an indirect role as an adhesive enhancing the bond between the plastic and metal pipe ends by decreasing corrosion.

8. A pipe coupling according to claim 7 wherein the pipe is formed from copper.

9. A pipe coupling according to claim 8 wherein the plastic pipe end or fitting is formed from materials selected from polyamides, polyethylene or polypropylene.

10. A method for effecting a coupling between a plastics pipe and a metallic pipe or pipe fitting comprising the steps of;

a) applying an organic or inorganic primer to the metallic pipe or pipe fitting,

b) applying heat to the metallic pipe end or fitting;

c) hot dipping the metallic pipe end or fitting;

d) introducing the hot dipped metallic pipe end or fitting into an injection moulding apparatus; then,

e) overmoulding the metal pipe or pipe fitting with the plastics material to effect said coupling.

10. A method according to claim 9 wherein the metal pipe or pipe fitting is hot dipped in a fluidised bed of plastics material the same as the plastics material used for overmoulding.

11. A method according to claim 10 wherein the overmoulding of the plastic pipe over the metallic pipe or pipe fitting effects an air tight and/or water tight seal.

12. A method according to claim 11 wherein the plastics material for the plastics pipe end is selected from thermoplastics such as polyamides (nylon) polyethylene or polypropylene.

13. A pipe coupling as hereinbefore described and with reference to the accompanying illustrations.

14. A method for effecting a pipe coupling as hereinbefore described and with reference to the accompanying illustrations.

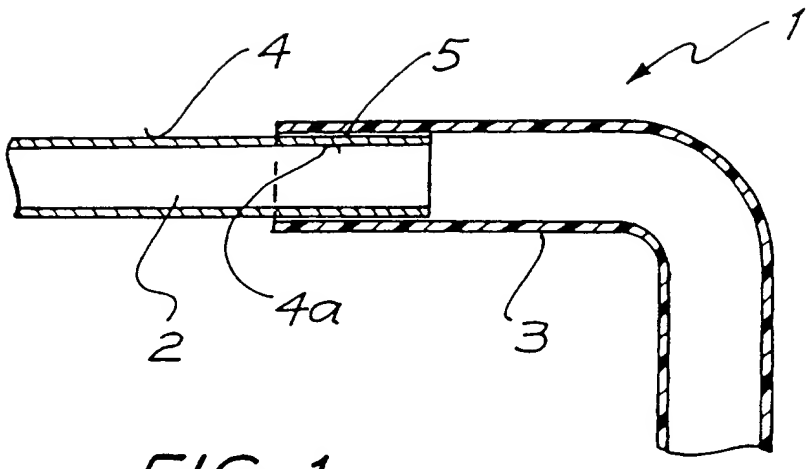

FIG. 1

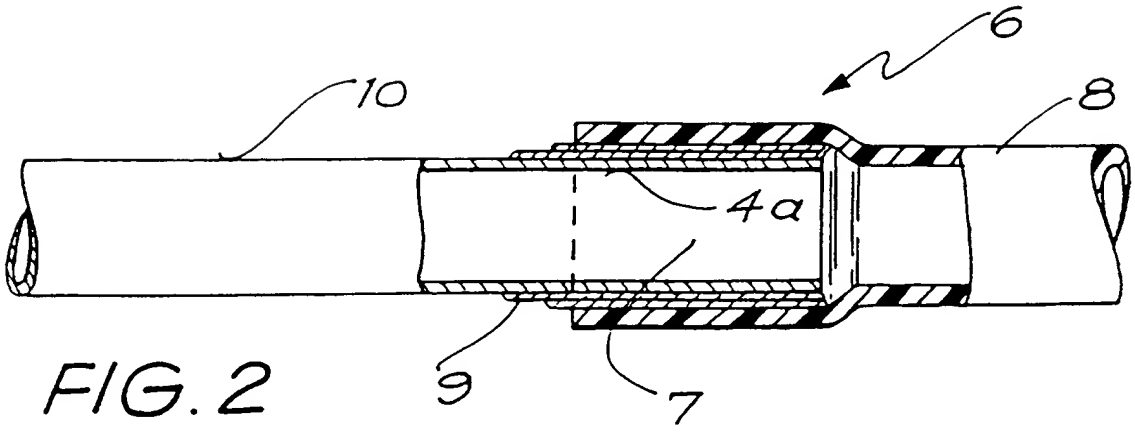

FIG. 2

INTERNATIONAL SEARCH R' ORT

International Application No.
PCT/AU 95/00736

A. CLASSIFICATION OF SUBJECT MATTER

Int Cl[6]: F16L 13/007,/10,/00, 47/02, 47/00, B29C 45/14, B29B 15/10

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F16L 13/007,/10,/00, 47/02, 47/00, B29C 45/14, B29B 15/10

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
AU : as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
DERWENT : dip; mould; plastic; metal + mould; dip ro primer; metal; mould + plastic

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP,A, 464415 (S. KANZAKI) 28 February 1992 Abstract and figures	1-12
Y	AU,A, 40486/68 (E.I. DU PONT DE NEMOURS & CO) 15 January 1970 Fig. 1, whole document	1-12
Y	AU,B, 50697/90 (629307) [PIPE COUPLINGS (A'ASIA) PTY LTD] 6 September 1990 Page 8, lines 7-25, fig. 2	1-12

[X] Further documents are listed in the continuation of Box C

[X] See patent family annex

* Special categories of cited documents:

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Date of the actual completion of the international search
13 March 1996

Date of mailing of the international search report
25TH MARCH 1996.

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C (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	AU,A, 45979/89 (YOSHIDA KOGYO K.K.) 2 August 1990 Page 2, lines 16 - page 3, line 9, fig. 1	1-12
Y	EP,A, 66704 (KARFA METALINDUSTRI A/S) 15 December 1982 Abstract, fig. 1	1-12
Y	EP,A, 243216 (CAOUTCHOUC MFG. ET PLASTIQUES) 28 October 1987 Abstract, fig. 3b	1-12
Y	EP,A, 426580 (CEBAL) 8 May 1991 Abstract, fig. 2	1-12
Y	EP,A, 447308 (ROCKWELL AUTO BODY SYSTEMS et al) 18 September 1991 Abstract, fig. 1	1-12
Y	FR,A, 2593432 (JACOBIAC C) 31 July 1987 Abstract, fig. 1	1-12
Y	FR,A, 2669576 (L'EUMAIL S.A) 29 May 1992 Abstract	1-12
Y	JP,A, 59121292 (HITACHI CABLE K.K.) 13 July 1984 Abstract	1-12
A	FR,A, 2304458 (VAHLBRAU K) 15 October 1976 Abstract, fig. 1	
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A	WO,A, 93/17215 (EDMAN) 2 September 1993 Abstract, fig. 2	
A	AU,A, 54726/94 (MOSS PRODUCTS PTY LTD) Claims 1 and 8, figs. 1 and 2	

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No.
PCT/AU 95/00736

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
AU	50697/90						
AU	45979/89	BR	8906590	EP	373624	JP	2164305
		US	5075066				
EP	66704	DK	1894/82				
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		NL	7317598	US	4104354	FR	2212222
WO	9317215	AU	36537/93	EP	627040	FI	943887
		NO	943131	SE	9200563		
AU	54726/94	GB	2274615				

END OF ANNEX